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USSR -
by M. V. Kozlova

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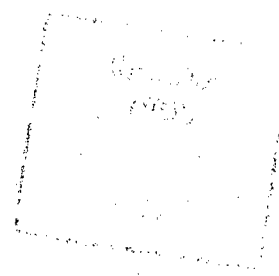
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FOREWORD

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SOME DATA ON THE RADIOACTIVITY OF VEGETABLES

- USSR -

Following is a translation of an article by M. V. Kozlova in the Russian-language periodical Voprosy Pitaniya (Problems of Nutrition), Moscow, Vol. 19, No. 4, June/August 1960, pages 83-85.

From the Radiological Laboratory (T. N. Dekeiper, Supervisor) of the Sanitation-Epidemiological Station, Moscow.

Until recently, necessary attention has not been given to radioactivity as a factor in contamination of external surroundings.

It is known that a natural radioactive background of external surroundings is conditioned basically by cosmic radiation and radioactivity in the ground. A tendency has been noted recently of an increase in this natural background (S. I. Gorshkov [See Note 1], 1958, N. F. Galanin [See Note 2], 1959; A. V. Lebedinskiy [See Note 3], 1959, and others). (Note 1: F. F. Erisman scientific research institute of sanitation and hygiene in Moscow. Materials on radioactive hygiene. Information bulletin No. 19-20. Some problems of hygiene in connection with the application of radioactive isotopes in agriculture. Moscow, 1958, page 77.) (Note 2: Conferences on radiology hygiene 6-10 April 1959. Theses of reports. Leningrad, page 3.) (Note 3: Medical radiology, 1957, No. 5, page 23.)

Radioactive substances in soils accumulate in plants and vegetables and reach the human organism. It is natural that the study of the content of radioactive substances in vegetables, used as food for the population, is real. With this purpose in mind we examined vegetables grown in the Moscow Oblast. Altogether 105 samples of vegetables were examined (potatoes, onions, carrots, cabbages, mushrooms and others). The selection of samples in this radiology examination was carried out in the usual sanitation-hygiene method.

Representatives of Rayon sanitation-epidemiology stations selected samples from storehouses and vegetable bins and supplied their exact documentary data (the products place of origin, invoice number, weight, etc.). Each sample weighed one kilogram. Preliminary to being tested for content of radioactive substance

the samples of vegetables, in batches of 700 grams, were carefully washed in a water tank containing continuously flowing water; the vegetables were dried between sheets of filter paper and, without having their skins removed, they were ground up in a meat grinder. After drying and grinding, the portions, which weighed 500 grams, were reduced to ashes at a temperature of 450-500° in a muffle furnace with a thermo-regulator. 300 mg. of ashes were then pulverized in a mortar and transferred to a standard aluminum calculating plate (2.5 sq. cm. in area, 4 mm. high). The computation of activity was made with the aid of a B-2 calculating apparatus on T-25 BFL type indicator.

Upon determining the activity in food products, the presence of natural radioactivity was calculated by taking 0.0119% of K^{40} . K^{40} was calculated in the different products on the basis of the general amount of potassium in these products.

According to A. V. Reisler (1952) [See Note], a human being who eats a mixture of foods receives 2-3 g. of Potassium per day. This Potassium contains 240-360 mg. of K^{40} with an activity of $2.6 \cdot 10^{-9}$ -- $1.7 \cdot 10^{-9}$ Curie units, i.e., each day a human being takes an average of $2 \cdot 10^{-9}$ Curie units of K^{40} into his organism. (Note: Hygiene of feeding. Moscow, 1952, page 102.)

The specific activity of K^{40} (expressed in Curie units) was computed by a formula set forth in a handbook by I. G. Gusev (1956). [See Note] (Note: Handbook on radioactive measurements and protection, Moscow, 1956.)

The formula is:

$$Q = 2.8 \cdot 10^{-6} \cdot A \cdot T,$$

where: A is the atomic weight: T is the period of semi-decay in years; Q is the weight in grams without an inactive carrier.

We calculated the possible quantity of K^{40} for several vegetables according to the indicated formula and put them into a table.

We utilized the relative method for determining specific activity, which is a method of comparing an examined substance with an activity standard under standard conditions (i.e., with identical materials and so forth).

As a standard we used potassium chloride (GOST 4234-48) and strontium ($SR^{90} + Y^{90}$), which are similar to the examined samples in their energy properties. Effectiveness fluctuated from 20.5 to 21.8%. Percent of relative error fluctuated from 5.7 to 10. The results of the observations were put into a table. All samples were converted into Curie units per one kg. weight of untreated product.

It is apparent from the table that the coefficient of divergence in K^{40} between the theoretical and the practical for Moscow and Moscow Oblast is insignificant.

We have established that radioactivity in the examined vegetables, used for feeding the population, did not exceed the theoretically established quantity and it is expressed to the degree of 10^{-9} of Curie units for one kilogram which corresponds to the normal content.

Our data agree with results obtained by co-workers of the Institute of Radiology Hygiene of the Ministry of Sanitation RSFSR (E. F. Romanovskaya, Y. Y. Kachanova, L. I. Yazeva, Y. A. Khvatova, V. V. Kolesnikov, V. A. Spirintsova, B. Y. Kiner, 1959).

/See note/ (Note: Conference on radiology hygiene 6-10 April 1959. Theses of reports. Leningrad, 1959, page 37.)

In the process of laboratory examination, it was learned that the following simplifications in the course of analysis could be recommended:

- (a) reduce the weight of a batch to 50 g.,
- (b) there is no need for drying to a constant weight, the drying can be limited,
- (c) the time for computing a sample can be reduced to 30 minutes.
- (d) reduce the amount of a batch of ashes to 200 mg.

A determination of the general amount of potassium in feed products and -- if there is increased activity -- the conducting of a radiochemical analysis is a further stage in our work.

Average Comparative Data of Radioactivity in Vegetables Growing in Different Areas
(in Curie Units per 1 kg.)

Name of Vegetable	In Moscow and Moscow Oblast	Fluctuation	Theoretical Content of K ₄₀	In Leningrad Oblast***	In Arkhangelsk Oblast***	In Karel'sk Oblast***	In Sakhalin Oblast***
Potato	2.79·10 ⁻⁹	2.15·10 ⁻⁹ -- 3.6·10 ⁻⁹	3.4·10 ⁻⁹	2.9·10 ⁻⁹	4.5·10 ⁻⁹	2.2·10 ⁻⁹	4.5·10 ⁻⁹
Carrot	2.60·10 ⁻⁹	1.2·10 ⁻⁹ -- 4.0·10 ⁻⁹	2.3·10 ⁻⁹	2.79·10 ⁻⁹	5.9·10 ⁻⁹	2.06·10 ⁻⁹	4.5·10 ⁻⁹
Beet	2.98·10 ⁻⁹	2.4·10 ⁻⁹ -- 4.37·10 ⁻⁹	2.37·10 ⁻⁹	--	--	--	5.0·10 ⁻⁹
Onion	1.3·10 ⁻⁹	0.88·10 ⁻⁹ -- 2.72·10 ⁻⁹	1.26·10 ⁻⁹	1.1·10 ⁻⁹	--	--	--
Mushroom, white pickled	0.6·10 ⁻⁹	0.3·10 ⁻⁹ -- 0.8·10 ⁻⁹	3.64·10 ⁻⁹ *	--	--	--	--
Sauerkraut	5.2·10 ⁻⁹	2.4·10 ⁻⁹ -- 7.9·10 ⁻⁹	1.7·10 ⁻⁹ **	--	--	--	--
Onion (tero)	3.2·10 ⁻⁹	--	1.44·10 ⁻⁹	3.0·10 ⁻⁹	--	--	1.8·10 ⁻⁹
Cucumber, fresh	1.75·10 ⁻⁹	--	2.7·10 ⁻⁹	--	--	--	1.75·10 ⁻⁹

* For fresh mushrooms

** For fresh cabbage

*** Data from workers of the Institute of Radiation Hygiene, Ministry of Sanitation, RSFSR, 1959